

# Bulletin Board

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### CHEMICAL EFFECTS

#### Application of Silica Nanoparticles Induces Different Effects on Inorganic and Methylated Arsenic Accumulation in Rice Grains: Insights from Arsenic Transformation in Soil

2025-04-19

Silica nanoparticles (SiNPs) are promising agrochemicals for reducing pollutant accumulation in plants. However, their applications sometimes fail to reduce arsenic in rice grains. Here, we explored the mechanisms using pot experiments via foliar and soil applications, respectively. Both applications significantly decreased As(III) (19.2-35.1%) and DMA (74.4-81.3%) in grains but increased As(V) by 1.2-1.8-fold. SiNP applications reduced As(III) but promoted As(V) in porewater during the flooding period. The As(III)-oxidation gene *aoA* showed a 1-3 orders of magnitude higher abundance than arsenic-reduction/methylation genes, and its abundance significantly increased after both applications. SiNP applications facilitated the release of Fe-bound organic carbon into porewater and promoted bacterial growth and As(III) oxidation, leading to high As(V) availability for rice uptake. Nevertheless, foliar spraying performed better than soil amendment in reducing total arsenic in grains by inhibiting stem/nodes-to-grain translocation. Our findings highlight the microbial arsenic transformation in soil regulated by SiNPs and demonstrate the advantages of foliar spraying in the arsenic-contaminated paddy field.

Authors: Yifan Gao, Xiangyi Liao, Jungang Deng, Jingjing Zhao, Guang Yang, Siyao Yan, Luyu Liang, Jinglin Yang, Guoyong Huang, Dandan Pan, Tongxu Liu, Xiaomin Li

Full Source: Journal of agricultural and food chemistry 2025 Apr 19. doi: 10.1021/acs.jafc.5c00644.

#### Microplastics as benzo-a-pyrene carriers: genotoxicity assessment simulating human gastric digestion

2025-04-19

Microplastic particles (MPs) are ubiquitous environmental pollutants that can remain in ecosystems for prolonged periods. Plastic materials undergo various degradation processes driven by chemical, physical, and biological factors that alter their size, shape, composition, and bioavailability. The gastrointestinal tract is the primary pathway through which MPs are absorbed, raising concerns as they can transport harmful pollutants and microorganisms into the body. Despite their widespread

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presence, the effects of exposure to MPs that vehicle environmental toxins are still not well understood. In this study, we rigorously simulated the photoaging processes of polystyrene MPs of two distinct sizes (1  $\mu\text{m}$  and 5  $\mu\text{m}$ ) and confirmed their capacity to adsorb benzo[a]pyrene, a known carcinogen. Moreover, we explored the transport capabilities of these MPs and analyzed their genotoxic effects on liver cells under simulated gastric digestion conditions. Our findings reveal that MPs enriched with BaP release this toxic compound when ingested and exposed to gastric juices, markedly increasing their toxicity compared to the individual components. This research underscores the alarming potential of MPs to exacerbate risks associated with environmental pollutants in human health.

Authors: Sebastiano La Maestra, Francesco D'Agostini, Mirko Benvenuti, Stefano Alberti, Mario Passalacqua, Francesca Gronda, Linda Ferrea

Full Source: Archives of toxicology 2025 Apr 19. doi: 10.1007/s00204-025-04046-8.

#### Key toxic pathways of hepatotoxicity induced by titanium dioxide nanoparticles through multi-omics analysis

2025-04-16

The liver is considered a target organ for the accumulation and toxic effects of nanomaterials exposed to the body, especially after oral exposure, but the key toxic pathways have not been fully defined. This study focused on the hepatotoxicity of titanium dioxide nanoparticles (TiO<sub>2</sub> NPs) in vivo and in vitro, and tried to identify key toxic pathways using the concept of systems biology and multi-omics methods. In vivo, protein and metabolomic sequencing were performed on the liver of SD rats (0, 50 mg/kg, 90 days), and 386 differential proteins and 29 differential metabolites were screened out, respectively, and the joint analysis found that they were significantly enriched in alanine, aspartate and glutamate metabolism, and butanoate metabolism. In vitro, exposure to TiO<sub>2</sub> NPs could induce cytotoxicity and omics changes at different molecular levels in human hepatocellular carcinoma cells. Single omic analysis showed that differentially expressed proteins and metabolites were 80 and 222, respectively. The enriched pathways related to steroid biosynthesis, cholesterol metabolism at the combine levels of proteome and metabolome. KEGG enrichment analysis showed that PI3K-Akt signaling pathway and PPAR signaling pathway were both significantly affected in vitro and in vivo. Through multi-omics analysis, this work offered fresh



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perspectives and avenues for research on the toxicity mechanism of TiO<sub>2</sub> NPs.

Authors: Jiaqi Shi, Ying Ma, Nairui Yu, Yi Zhang, Zongfu Cao, Li Guan, Xiaodong Liu, Zhangjian Chen, Guang Jia

Full Source: Food and chemical toxicology: an international journal published for the British Industrial Biological Research Association 2025 Apr 16:115457. doi: 10.1016/j.fct.2025.115457.

## ENVIRONMENTAL RESEARCH

### Sunscreens and Their Impact on Human Health and the Environment: A Review

2025-04-18

The harmful effects of excessive sun exposure are well-documented, driving a significant increase in the use of photoprotection measures. However, some active ingredients in topical sunscreens, particularly organic or chemical UV filters, have raised concerns regarding their potential adverse effects on human health and the environment. This review examines the existing literature on the risks associated with sunscreen filters, highlighting both cutaneous reactions and systemic absorption, which may contribute to endocrine disruption. Additionally, the environmental impact of sunscreens is addressed, with a focus on their accumulation in marine ecosystems. Alternatives to traditional organic UV filters, including mineral filters, are evaluated for their safety and efficacy profiles.

Authors: Miquel Just-Sarobé

Full Source: International journal of dermatology 2025 Apr 18. doi: 10.1111/ijd.17800.

## PHARMACEUTICAL/TOXICOLOGY

### Endocrine disruption potential of dust in children's indoor environments: Associations with multiple chemicals from various compound classes across exposure matrices used for health risk assessment

2025-04-16

Indoor dust contains a complex mixture of chemicals, including endocrine-disrupting chemicals (EDCs), which may pose risks to children's health. As children spend most of their time indoors and have frequent dust

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contact, their exposure is heightened. This study quantified the endocrine disrupting potential of dust from children's indoor environments in Sweden, and assessed associations with flame retardants and plasticizers in dust, handwipes, and urine. Fifty dust samples from 18 homes and 11 preschool units were analyzed for estrogen, anti-androgen, and thyroid receptor activities using human osteosarcoma cell-based luciferase reporter assays. Associations were evaluated with 21 legacy and 18 emerging halogenated flame retardants (HFRs) and 11 organophosphate esters (OPEs) in dust and handwipes, as well as nine plasticizers (eight phthalates and di-isononyl cyclohexane 1,2-dicarboxylate (DiNCH)) in dust, and 14 plasticizer metabolites in urine. Samples for biological and chemical analyses were collected from the same designated areas within a limited time frame. Most dust samples exhibited estrogen receptor agonist (ER) and androgen receptor antagonistic (anti-AR) activity, while thyroid receptor (TR) induction was low. Preschool dust showed significantly higher estrogenic activity than home dust. No seasonal variation was observed. Associations were observed between dust hormonal activities and urinary plasticizer metabolites, as well as HFR and OPE concentrations in dust and handwipes. Relative potency (REP) analyses of 36 HFRs and OPEs revealed notable anti-AR activity for 2,2',4,4'-tetrabromodiphenyl ether (BDE-47) (REP values  $0.85 \pm 0.10$  (EC<sub>25</sub>) and  $0.93 \pm 0.07$  (EC<sub>50</sub>)) and 2,2',4,4',6-pentabromo diphenyl ether (BDE-100) (REP values  $2.74 \pm 0.29$  (EC<sub>25</sub>) and  $3.23 \pm 0.42$  (EC<sub>50</sub>)). Additionally, BDE-100 showed low ER induction.

Authors: Ylva Sjöström, Breanne Holmes, Niklas Ricklund, Nathalie Struwe, Katja Hagström, Jessika Hagberg, Maria Larsson

Full Source: Environmental research 2025 Apr 16:121614. doi: 10.1016/j.envres.2025.121614.

### Association between humidifier disinfectant use and development of lung cancer: A nested case-cohort study

2025-04-17

Objective: The outbreak of lung disease among humidifier disinfectants (HDs) users lead to the identification of humidifier disinfectants-associated lung injury (HDLI) cases. Subsequent research highlighted the respiratory health risks associated HDs but the connection to lung cancer remained uncertain. To assess the risk of lung cancer development among individuals exposed to HDs and to investigate the characteristics of HDs exposure influencing the occurrence of lung cancer.

Materials and methods: A cohort study was conducted using the national database, encompassing 7343 claimants exposed to HDs. The study



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focused on 195 confirmed lung cancer cases, employing the standardized incidence ratio (SIR) for comparisons with the general population, and the odds ratio (OR) using propensity score matching for internal comparisons. Results: The study found a significantly higher incidence of lung cancer among individuals exposed to HDs compared to the general Korean population, with elevated SIRs observed in both men and women (SIR = 3.43, 95 % CI = 2.81-4.13 for men; SIR = 11.19, 95 % CI = 8.95-13.82 for women). In the propensity score-matched case-control design, a longer duration of HDs use was associated with an increased risk of lung cancer (OR = 2.48, 95 % CI = 1.35-4.56 for using HDs for more than 49 months and OR = 1.02, 95 % CI = 1.01 - 1.03 for every one month).

Conclusion: The findings suggest a potential association between HDs exposure and an increased risk of lung cancer.

Authors: Soyoung Park, Yeon-Soon Ahn, Jungyun Lim, Sol Yu, Younghee Kim, Jongin Lee

Full Source: Cancer epidemiology 2025 Apr 17:97:102822. doi: 10.1016/j.canep.2025.102822.

### Associations of exposure to arsenic species and endogenous sex hormones with oral cancer: a hospital-based study in Southeastern China

2025-04-16

The effects of arsenic species and endogenous sex hormones on oral cancer risk, particularly their molecular interactions, have been infrequently reported. This study aimed to assess the individual and combined effects of arsenic species and endogenous sex hormones on oral cancer risk and elucidate the association between hormones, arsenic species, and arsenic metabolism. A case-control study (comprising 144 cases and 144 controls) was conducted from January 2020 to January 2024 in Southeastern China. Serum levels of six arsenic species and nine endogenous sex hormones were measured using High-Performance Liquid Chromatography Inductively Coupled Plasma Mass Spectrometry (HPLC-ICP-MS) and ultra-high performance liquid chromatography-high resolution mass spectrometry (UPLC-HRMS), respectively. After adjusting for potential confounders, Logistic regression showed that high exposure levels of inorganic arsenic (IAs) (adjusted OR [aOR] and 95%CI: 0.00[0.00,0.44] and 0.45[0.25,0.78]) and Cortisone (aOR and 95%CI: 0.16[0.07,0.35] and 0.19[0.10,0.37]) were associated with reduced oral cancer risk, both as continuous and categorical variables. Serum Melatonin, Cortisone, and Testosterone levels correlated with partial arsenic species, while Cortisone and Melatonin were linked to arsenic

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methylation metabolic indexes (spearman's test  $P < 0.05$ ). Quantile g-computation analysis revealed that Corticosterone and Cortisone had the largest positive and negative weights on oral cancer risk, respectively (weights=0.640 and 0.525). The combined effect of arsenic species and hormones on oral cancer was protective ( $\beta$  and 95%CI: -0.36(-0.05,-0.67)), with slight gender differences. Independent of other arsenic species and hormone levels, Cortisone exhibited a protective effect against oral cancer in BKMR analysis. Additionally, an interaction effect between Melatonin and other arsenic species was also observed. In summary, Serum IAs and Cortisone were negatively associated with oral cancer, while Corticosterone showed a positive association. Further cohort studies are needed to confirm and elucidate these mechanisms.

Authors: Na Wang, Wenting Zhang, Haoyuan Song, Weihai Huang, Fa Chen, Fengqiong Liu, Yulan Lin, Yu Qiu, Bin Shi, Lisong Lin, Jing Wang, Baochang He

Full Source: Environmental pollution (Barking, Essex : 1987) 2025 Apr 16:126259. doi: 10.1016/j.envpol.2025.126259.

## OCCUPATIONAL

### Correlation between 6PPD-Q and immune along with metabolic dysregulation induced liver lesions in outdoor workers

2025-04-12

Outdoor workers who are exposed to traffic-derived pollutants often suffer from a range of diseases, with liver disease being particularly notable. Recently, a rubber stabilizing additive antioxidant N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) and its transformed-quinone product 6PPD-quinone (6PPD-Q) attracted attention. However, their implication for human health remains inadequately elucidated. In this study, outdoor and indoor workers were recruited to analyze 6PPD and 6PPD-Q distribution in their serum and urine. Simultaneously, blood cell counts, liver function, renal function, blood glucose level, and lipid profile were evaluated by 23 physiological parameters. For the first time, we found that the concentrations of 6PPD (0.54 - 1.66  $\mu\text{g L}^{-1}$ ) and 6PPD-Q (0.58 - 4.04  $\mu\text{g L}^{-1}$ ) in outdoor group serum were two- and three-fold in the indoor group, respectively. Compared with indoor workers, 18 biochemical parameters, notably total bilirubin and indirect bilirubin, were elevated in outdoor workers ( $p < 0.05$ ). A computed tomography scan showed liver lesions in 60% of the outdoor group, whereas only 30% of



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the indoor group. The statistical analysis exhibited that significant positive correlations exist between the serum 6PPD-Q and immune cell counts, total bilirubin, indirect bilirubin, and triglycerides in human beings ( $p < 0.05$ ). The logistic regression implied that for each  $1 \mu\text{g L}^{-1}$  increase of 6PPD-Q in serum, the risk of human liver lesions increased by 2.31 times. Our results suggest that outdoor exposure is associated with increased concentrations of 6PPD-Q in serum, which could potentially influence glucose and lipid metabolism, immune cell regulation, and liver health.

Authors: Zhihao Qin, Yan Li, Yanlan Qin, Zhongli Chen, Jinsong Guo, Fang Fang, Andreas Schäffer, Henner Hollert, Ying Shao

Full Source: Environment international 2025 Apr 12;199:109455. doi: 10.1016/j.envint.2025.109455.

### Exposure to phenols mixture, oxidative stress, and fasting blood glucose: Association and potential mediation analyses

2025-04-17

Phenols exposure may affect glucose metabolism and increase the risk of type 2 diabetes (T2D). However, the underlying biological mechanisms were poorly understood. In this longitudinal panel study of 122 Chinese adults with three repeated measurements, we aimed to evaluate the associations of multiple phenols exposure with fasting blood glucose (FBG), odds of impaired fasting glucose (IFG) and T2D, and further assess the mediating role of oxidative stress in the above associations. FBG and urinary concentrations of 6 phenols and 3 oxidative stress biomarkers were repeatedly measured for each participant. Linear mixed-effect (LME) models, generalized estimating equations (GEEs), quantile g-computation models, and structural equation models (SEM) were employed to estimate the associations. We observed that urinary methyl paraben (MeP), ethyl paraben (EtP), and propyl paraben (PrP) at multiple lag days were independently associated with increased FBG (all  $P\text{-FDR} < 0.05$ ). Exposure to phenols mixture at lag 0 day was positively correlated with FBG, and urinary PrP was the predominant contributor. Meanwhile, exposure to phenols mixture at lag 1 day or at lag 3 day was marginally linked to increased FBG. No significant relationships of phenols exposure at different lag days with risk of IFG and T2D were observed. In addition, we found that 8-hydroxy-deoxyguanosine (8-OHdG) mediated 35.7% of the association of urinary phenols mixture at lag 1 day with FBG. Our study revealed that phenols exposure, either separately or as a mixture,

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was related to increased FBG, and oxidative stress is a potential mediating mechanism.

Authors: Ziqian Zhang, Min Xiang, Huihua Yang, Wenting Guo, Tao Bai, Rongchuan Huang, Xiaomin Zhang, Liangle Yang

Full Source: Free radical biology & medicine 2025 Apr 17;S0891-5849(25)00234-5. doi: 10.1016/j.freeradbiomed.2025.04.024.

### Childhood exposure to polycyclic aromatic hydrocarbons (PAHs) and cardiometabolic indicators in childhood and adolescence: findings from a cohort study in rural Bangladesh

2025-04-18

Background: Exposure to polycyclic aromatic hydrocarbons (PAHs) has been associated with cardiovascular diseases in adulthood, but studies examining childhood origins are scarce.

Objective: To examine associations of childhood PAH exposure with cardiometabolic risk indicators in childhood and adolescence along with differences by sex.

Methods: Urinary PAH metabolites [ $\Sigma 1,2,3$ -hydroxyphenanthrene ( $\Sigma 1,2,3$ -OH Phe), 1-hydroxypyrene (1-OH Pyr), and  $\Sigma 2,3$ -hydroxyfluorene ( $\Sigma 2,3$ -OH Flu)] were measured in 9-year-olds from the MINIMat cohort in Bangladesh ( $n=196$ ), using liquid chromatography with tandem mass spectrometry. Cardiometabolic indicators [lipids, C-reactive protein (CRP), insulin resistance (HOMA2 IR), blood pressure, anthropometry, and a composite cardiometabolic risk score (CMRS)] were assessed at 9 and 15 years. Associations of PAH metabolites (log2-transformed) with cardiometabolic indicators were assessed using multivariable-adjusted linear and logistic regression models.

Results: In all children, urinary 1-OH Pyr (median: 1.6 ng/mL) was positively associated with body mass index z-score at 9 and 15 years, and with triglyceride/high-density lipoprotein (HDL), cholesterol/HDL ratios, waist circumference, CMRS, and CRP at 15 years. After sex stratification, consistent associations were mainly observed in girls, especially with outcomes at age 15, where both urinary 1-OH Pyr and  $\Sigma 1,2,3$ -OH Phe concentrations were inversely associated with HDL, and positively associated with cholesterol/HDL ratios and CMRS. Urinary 1-OH Pyr was also positively associated with girls' triglyceride/HDL ratio, HOMA2 IR, waist circumference, and CRP.

Conclusions: Our associations of childhood PAH exposure with cardiometabolic indicators in childhood and adolescence differed by sex. In girls, increased adiposity, indications of altered lipid profile and

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metabolic function were detected while boys seem incongruently affected.

Authors: Mercedes Trask, Syed Moshfiquur Rahman, Mariza Kampouri, Rubhana Raqib, Eva-Charlotte Ekström, Eero Kajantie, Mohammad Redwanul Islam, Annette M Kraus, Christian Lindh, Anisur Rahman, Maria Kippler

Full Source: Environmental research 2025 Apr 18:121653. doi: 10.1016/j.envres.2025.121653.